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Deterministic Project Management with AI Applicability in Globalized Context

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Abstract

This paper identifies the rationale underlying the low success rates for globalized projects. Instead of having a traditional project manager in managing the outcomes of a globalized project, the notion of a project neoteric with manifold attributes and an emphasis in managing the process is preferred. Given the incongruence and discrepancy in planning as well as execution of activities between the Headquarters Team and the Localized Team in globalized project operation, a framework for exploiting different kinds of AI technology is proposed with the sole purpose of minimizing project estimation errors and enhancing the success rate of globalized projects. In summary, AI technology with predictive analytics and in conjunction with project neoterics offer businesses a competitive advantage and possibilities to improve project outcomes by deterministically focusing on managerial processes of project management.

Keywords: Deterministic Project Management, AI Technology, Project Neoterics, Globalized Project, Complexity, Error Propagation

1 Introduction

The rate of success for IT projects is relatively low, particularly for projects of significant size and complexity in globalized operation [1] [2][3]. To enhance the success of such complex globalized projects from the outset; a new approach of assessing the complexity of globalized project during the planning phase; a non-linearized formula for minimization of project estimation errors; and the deployment of deterministic AI technologies during the execution phase are required. Whereas some Project Managers are primarily concerned with maintaining the status quo within predetermined constraints (scope, budget, schedule and quality) in the planning, execution, or monitoring of a project, Shafiq et al. contend that Global Software Development (GSD) projects lack the resources to address the change management and process challenges [29]. Consequently, this paper suggests that project neoterics with manifold leadership attributes are more focussed on making deterministic decisions (with purpose, directionality and specificity) by effectively deploying advanced IT resources/tools to enhance the successful outcome of a project.

With the proliferation and advancement of Artificial Intelligence (AI) technology [4][5], project neoterics can exploit the capacity, capability and innovative power of the AI technology to supplement their planning, execution, control and monitoring of globalized project undertakings. For example, Wauters and Vanhoucke employed an AI-based prediction method of a Nearest Neighbour to refine project duration forecasting [30]. Hammouch, Medromi and Sayouti used multi-intelligent AI agents to monitor the progress of projects and anticipate potential failure issues [31].

In this paper, a manifold spectrum of attributes for project neoterics is identified and a framework for exploiting different kinds of AI technology is discussed with the sole purpose of minimizing project estimation errors and enhancing the success rate of globalized projects. AI technologies with predictive analytics and in conjunction with project neoterics offer businesses a competitive advantage and possibilities to improve project outcomes [6] by focusing on managerial processes of project management [7].

2 What is a globalized project?

Traditionally, a project is a structured process, embodying a set of planned, coordinated and controlled activities with predetermined commencement and completion dates; it is further delineated with identified scope as well as objectives to be attained within the boundary constraints of time, cost, scope, quality and allocated resources.

Binder (2009) defines a globalized project "as an undertaking by an enterprise that is structured with concrete and involving manifold teams or distinct enterprises unveiling a wide geographic dispersion" [8].

In recent years, a globalized project is manifested in a manifold structural hierarchical approach [9] [21] [22] : usually with the headquarters

team (HQ) responsible for planning and coordination of the project in developed countries (e.g. EU, USA, Canada, etc.) and the field team (FT) performing operation and support for the project in developing countries (e.g. Brazil, China, India, etc.); spreading over a number of political jurisdictions and spanning over multiple financial quarters in successive fiscal years. These distributed teams tend to be multi-disciplinary in nature, having complex challenges requiring creativity, collaboration, innovation and leadership.

3 Characterization of Complex Globalized Project

As a result of globalization over the past two decades, we have witnessed an exponential growth in the number of complex, globalized projects being undertaken in the world. With the mobilization of headquarters staff and subsidiary units mostly in developed countries, coordination with external consultants and entities, execution capability by localized teams, the size, complexity and dimensionality have increased significantly over the past years [9]. Examples of multinational Mega projects are Multi-Country Development Project on 5G Mobile Communication Technology, Galileo Positioning System, La Guardia Airport in New York, ZhuHai-Macao Bridge in China-Hong Kong-Macau; Ten-T Core Network Project in Europe [32].

Typically, a globalized project has a substantial budget, spread over multiple financial reporting periods and consuming significant amounts of company resources. Globalized project characteristics categorically include intrinsic, extrinsic, enterprising, situational and contextual dimensions. Therefore, each complex globalized project faces a myriad of diverse challenges [10][11] which are not easy to be circumvented, minimized or mitigated. Based on the literature researched [27][28], the challenges include but are not limited to:

- Adherence to political, jurisdictional, social reality of the multinational environment;
- Deployment, mobilization, management and coordination of multinational teams;
- Cross-border complexity in contract administration for service and product acquisitions and delivery;
- Streamlining, balancing and harmonization of competing interests of multinational stakeholders;
- Estimating, tracking and handling of uncertainty, risks and emergencies as well as implementations of changes in cross-border environments;
- Divergent and sometimes conflicting cultural behaviors arising from cross-cultural misunderstanding, discrepancies and perspectives;

4 Dimensionality, Complexity and Volatility of Globalized Project

Based on the literature researched [12][13][14], ten dimensions of attributes for capturing the complexity and dimensionality of globalized projects are identified. In addition, a spider-web diagrammatical tool is employed to depict the extent of complexity along each of the ten identified dimensions (Figure 1 – Spider web diagram). The traced-out spider web will capture succinctly the level of complexity of a project, thereby proportionately indicating the appropriate attention to be paid and resources to be allocated for the project. This will enable the planning and estimation of resources required for the successful completion of the project to be done more objectively and realistically from the outset. Figure 1 depicts these dimensions and their relationships:

• structural complexity can include project uncertainty, managing a large number of interconnected tasks and interfaces;

• technical complexity can include projects with several variables such as multi-technology platforms, usability, maintainability and support;

• directional complexity can include projects characterized by confusion from unclear understanding of project objectives and incongruent goals;

• temporal complexity can include projects impacted by new technological developments and sudden changes in government regulations;

• cognitive complexity can include the nature of thinking required for projects and characterized by project understanding, analysis, and synthesis;

• operational complexity can include projects characterized by managing interrelationships and interconnectedness between people, process and technology;

• social complexity can include projects characterized by an understanding of political and economic institutions and their impact;

. cultural complexity can include projects characterized by diversity in ways of planning, execution, problem-solving, perception of issues due to differences in country or corporation cultures.

• linguistic diversity can include the diversity of traits such as language, grammar, accents and is characteristic of a place, region, or country;

• strategic leadership (corporate and team) includes incorporating strategy in the management of projects to ensure alignment with corporate goals and direction.

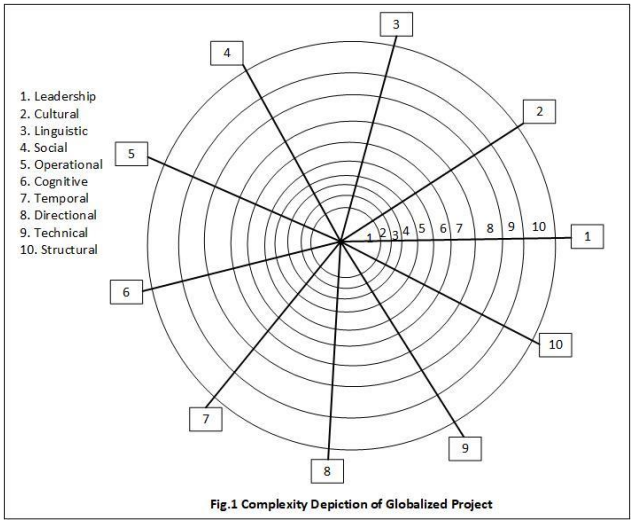

Fig.1 Complexity Depiction of Globalized Project

Along each identified dimension, the project team collectively determines the extent of complexity by normatively assigns a rating based on a linearized scale of 1 to 10, with 1 being the least and 10 being the most complex level. Once the scores on each dimension, the resource requirements in each area for the whole project can be estimated with ease, objectivity

and comparatively higher precision. In addition, the figure illustrates the dynamic relationships between these dimensions.

In effectively managing complex globalized projects, there must be a continual balance between the headquarters team and localized teams. These teams may be spread over multiple geographical points. Figure 2 depicts that optimal operational effectiveness can be accomplished by balancing headquarters competency with the localized teams' competency in developing countries, and ensuring that such a balanced relationship is maintained over project life. This balanced relationship attempts to minimize conflicts, incongruences and discrepancies between the HQ and FT in planning and operation of the project.

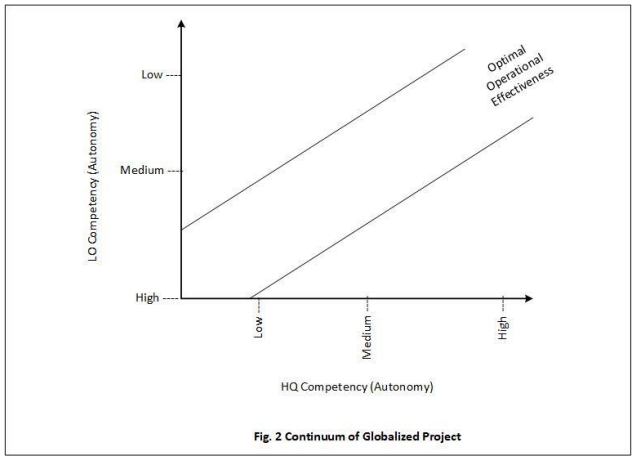

Fig. 2 Continuum of Globalized Project

5 Pitfalls of Globalized Projects

The execution of complex globalized projects today often involves geographically dispersed teams. As a result, the de facto modus operandi involving different strategy, approach, assumption, perspective and practice would create and precipitate incongruences, errors and mistakes. This situation would further be compounded as a result of differences in cultures, communication styles, work practices and the offerings of trust [15][21][22]. Team support and knowledge sharing would sometimes be insurmountable due to time zone differences, work habits, and cognitive orientations. Hofstede's analyses of cross-cultural differences [16] underlined the importance of localized work styles and practices in the effective performance of tasks on a project. As a result of the proliferation of internet and hand-held device technologies, various asynchronous and synchronous, smart applications are recently available to facilitate effective communication for project status; collaborative work; as well as knowledge sharing, and other project related tasks in a virtual environment.

Traditionally, project managers establish the targeted outcomes of the globalized projects and strive to maintain the status quos during the course of the whole project. The established boundary is often derailed or exceeded due to uncertainty, risks and challenges during the course of the project. Globalized projects must be managed with a different mindset and a continual tendency to embrace paradigm shift through timely improvements. The person who is in charge of a project must therefore be versatile in strategy; more precise in estimation; more innovative in solutions; continually improves in approaches; and balances the competing interests of multi-national stakeholders. This person is called a project neoteric, who is more concerned with the management of the project process rather than the outcomes of the project process.

6 Project Success and Failures: management of process versus management of outcomes

Project neoterics primarily differentiate between project outcome success as well as project management success and thrive over both domains. Normatively speaking, project neoterics survey and balance diverse issues in politico-legal environment, economic situation, socio-cultural background and physical environment, language barriers, geographic distances, and cross cultural gaps [9] [10] [11] between HQ operation and in localized settings. Nevertheless, there are many challenges (uncertainties and risks) that eventually lead to failures for the project outcomes [27] [28]. Figure 3 illustrates that to achieve project success and achieve optimal outcomes, a dynamic relationship needs to be balanced and managed accordingly.

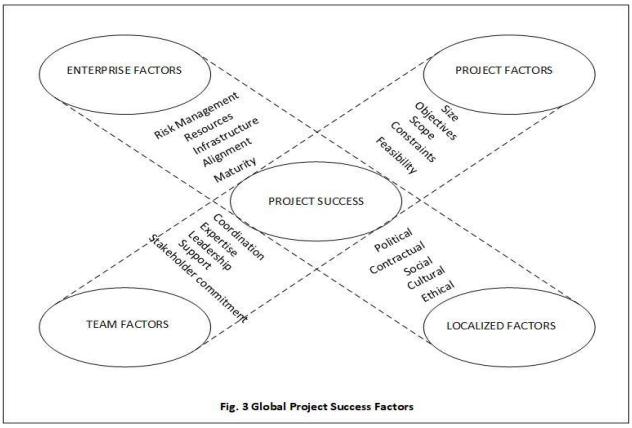

Fig. 3 Global Project Success Factors

7 Rationale underlying low project success: Estimation Error/Propagation

In project management, it is customary to use a linearized, non-quantitative scale of "low-medium-high" to quantify the effect/impact of a measure in project management, particularly in risk management and analysis. The assumption of linearized, equal divisional separations between low-medium and between medium-high have been proven by Vance et. Al. [17] to generate erroneous rating of a measure. Vance et.al. proved in their paper that the rate of error in estimation arising from such a use of linearized, equal divisional scale is as high as 50%. The propagation and compounding of such 50% estimation errors in multiple attributes would eventually lead to the derailment of the set constraints of budget, time, scope and quality. This thereby may explain why the rate of project success in IT remains to be very low [10]. Vance et.al subsequently proposed the divisional separation for categorical ratings of "low-medium-high" to be on a linear scale of 1-3-9 instead 1-2-3. Such a rating scale with unequal separation is shown to provide a 90% accuracy (or 10% error rate) in estimation.

8 Applicability of AI to project management domains

Different kinds of AI technology have been deployed to enhance the estimation accuracy in project management monitoring [23][24][25][26]. Costantino et al., (2015) [18], describe *Neural Network* as an artificial network that is based on the biological functioning of the human brain. It

accepts input from the external environment and makes relationships between data in order to arrive at solutions.

In addition, Martínez and Fernández-Rodríguez, (2015) outline other AI technology and suggest the following common project success algorithms that can be applied to measure success rate of projects [19]:

Fuzzy Cognitive Maps which are defined as nodes of graphical objects that are used to facilitate the presentation of causal reasoning. It is a combination of fuzzy logic and cognitive mapping and can be a useful tool in understanding and analysis of complex systems.

Genetic Algorithms are tools that are used to mimic the natural human thought processes that are applied to solve complex problems. It can be used for designing algorithms for scheduling tasks and optimizing resources.

Bayesian Model involves AI networks based on probability distribution techniques for classifying data into categories and works well in managing situations where some of the data entries are not available.

Evolutionary Fuzzy Neural Inference Model (EFNIM) is described as a tool that integrates the strengths of "genetic algorithm, fuzzy logic, and neutral networks" to enhance the resolution on engineering problems.

Support Vector Machine is identified as an advanced learning tool in AI technology. This new tool is noted for its ability to address shortcomings of other techniques such as categorization and regression analysis.

K-Means Clustering provides the ability to create categories from complex image data by using "pattern detection".

Adaptive boosting neural networks/ Bootstrap aggregating neural networks are Artificial Neural Networks that designed to enhance the clustering or categorization techniques in the decision-making process.

Multiagent systems (MAS) are described by Yan et al., (2000) [20]as a distributed AI network that utilizes agent objects to collect and process data. These computer systems also have the autonomy and intelligence to make decisions based on localized environmental conditions.

Specifically, the applicability of AI empowers the followings in project management domains:

1. Estimation of project success

2. Identification of critical success factors

3. Relatedness to project budget

4. Connection to project schedule

5. Project planning

6. Relatedness to risk identification

The usage of artificial intelligence supported by intelligent systems will help people make better decisions. As gleaned from extensive literature review, process design and application of information technology is promising when they are used together for addressing tomorrows' organizational challenges and in building healthy systems [19].

Organizations strongly rely on decision support systems, such as business intelligence systems, to have competitive advantage. The outcomes of such systems should result in creative approaches, design thinking for process improvement, and can be used to generate new solutions for organizations in order to understand how answers can be created and deployed for competitive advantage. Increased importance of the contribution of the project manager also brings necessity for proactive management and better decision making. It is shown that adapting artificial intelligence can help to predict and analyze performance, and find insights about not previously associated effects.

9 Proposed Framework

Globalization of projects has resulted in a more complex network of project teams necessitating a systematic, proactive and collaborative monitoring, coordinating as well as controlling of identified project tasks or activ-

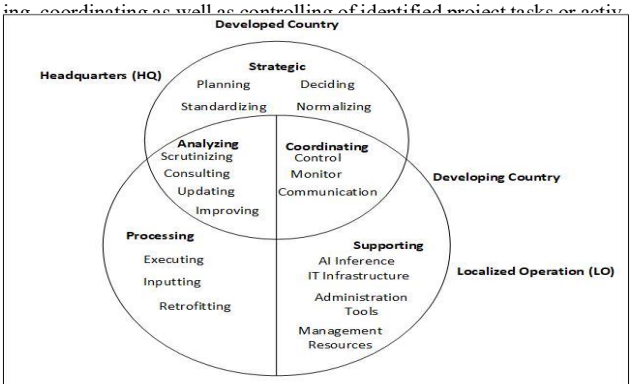

Fig. 4 Two-Tiered Framework For Managing Globalized Project

Figure-4 depicts a 2-tiered framework for managing globalized projects. As explained earlier, the headquarters (HQ) of globalized project team are mostly in developed countries. Typically, planning and decision makings are rendered at this level of the corporate hierarchy. Conventionally, planning, monitoring and decision makings are done in the context of the HQ corporate culture and from the perspectives of the work practice in developed countries. As a result, the planning, monitoring or decision makings may inadvertently overlook the crucial reality in the actual operational and execution context faced by the Field Team (FT) in developing countries.

Due to cultural differences, social practices and approaches in problem solving, the Field Team may execute tasks, tackle issues or solve problems in a totally different manner. Sometimes, inputs or feedbacks from the field may not reach the HQ decision makers in a timely manner to amend, improve or rectify the planned measures. Frequently, there are very few channels established between the HQ and FTs to promptly responds with a fully discussed or mutually agreed upon solution. In times of emergencies, this would make the whole process problematic or infeasible.

In order to circumvent these situations, we propose a 2-tier mechanism whereby the HQ Team would be responsible for the overall strategic direction and planning of the project. In addition, based on the inputs and feedbacks from the Field Team, the HQ Team and Field Team would jointly scrutinize, consult, update or improve the approach taken. With the proliferation of advanced communication technologies, this renders the virtual collaboration entirely possible. Furthermore, the two teams would continue to collaborate in the overall coordination of the project by controlling, monitoring and communicating jointly in a streamlined interleaving manner.

The Field Team mostly in developing countries would focus on undertaking and processing in terms of executing, inputting and retrofitting. Concurrently, FT would put together the necessary supporting infrastructures in terms of the provision of AI Inferential Tools, Administration tools and adequate resources to ensure the successful completion of the projects.

This proposed framework underlines, between HQ and FT, the importance of participatory decision making; continuous monitoring; collaborative feedback and improvement; discrete and empowered planning; and convergence of diverse approaches. With the deployment of AI applicability, the framework aims at enhancing project planning, project performance, project impact on the customer as well as enterprise business in the undertakings of globalized projects.

10 Conclusion

This paper has presented the notion that different kinds of AI technology can be deployed to enhance the estimation accuracy in project management monitoring. With the proliferation and advancement of Artificial Intelligence (AI) technology, project neoterics can be used to exploit the capacity, capability and innovative power of the AI technology to supplement the planning, execution, control and monitoring of globalized project undertakings.

The usage of artificial intelligence supported by intelligent systems will help people make better decisions. A spectrum of attributes for project neoterics and a framework for exploiting AI technology with the sole purpose of enhancing the success rate of globalized project undertakings is described.

Project neoterics distinguish project success concepts, focusing on managerial processes of project management on the one hand, and the traditional Triple Constraint of scope, schedule, budget and quality on the other hand. The project neoteric balances the competing interests of multi-national stakeholders and is more concerned with the management of the project process rather than the outcomes of the project process.

Lastly, the proposed 2-tiered framework between HQ and FT will enhance the success outcome with more streamlined planning, execution, monitoring and change management in the undertaking of globalized projects.

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Conflict of Interest: none declared.

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